January 1942

ET-189

United States Department of Agriculture
Bureau of Entomology and Plant Quarantine

A LEAF PUNCH FOR USE IN INSECTICIDAL RESIDUE STUDIES

By Robert A. Fulton, Division of Insecticide Investigations

There is often need for a sampling device to remove portions of a leaf of known area for the determination of dust or spray residues. The leaf cutter herein described was constructed to provide a unit to remove 2 square centimeters of leaf material from a citrus leaf.

The essential principle involved is similar to that commonly used in leather punches, i. e., the cutting unit is forced through the material against a soft surface, such as lead or tin. This principle is more satisfactory than the shearing action used in cardboard and paper punches.

The unit was designed to be operated by one hand and with an action and a grip similar to those used in small firearms. By increasing the length of the trigger all the fingers are used in applying the pressure to the cutting head. The upper end of the trigger is designed to produce a maximum travel of the thrust arm while the cutter is being closed. The curvature of the trigger arm is such that a compound lever effect is obtained near the end of the stroke. The leaf is then forced against the cutter by the lead disc on the end of the thrust arm. The leaf disc remains in the cutter and is gradually forced into a test tube, which holds the sample. When all the discs have been cut from the respective plot, the remaining discs are forced into the test tube. A small counter is mounted on the side of the sampler with a connection to the thrust arm.

Two views of the apparatus are shown in figures 1 and 2 and a sectional drawing in figure 3.

In the construction of the punch, the frame, trigger and thrust arm (A, B, C, fig. 3) were cut from quarter-inch sheet aluminum. The trigger was made in three pieces and riveted together to provide a bearing on both sides of the frame. The compression unit (D) was made of brass. A slot was cut to allow the unit to straddle the frame and form a double bearing at K. The top of the compression unit was threaded for a flanged cap to hold a lead disc. The cutter holder (L) was made of brass and grooved to fit over the frame. This unit was then held rigid by rivets. The test tube holder (G) was made to fit over the end of the frame. A small steel wire loop covered with rubber tubing was used to support the glass tube. Holes were drilled in the removable unit, and the wire support was attached with solder. The support was then drilled and threaded for a screw (H) to hold the test tube holder in place. A sponge rubber gasket (F) was inserted between the end of the test tube and the cutter holder to prevent breakage of the glass when the punch was being used. The cutting unit (E) was machined from five-eighths-inch steel tubing. The cutting tool was tempered in powdered sodium cyanide. This process will produce an exceptionally hard cutting edge. A small spring (J) was used to release the punch.

The device has been used for 1 year in determining the sulfur deposits on orange and lemon foliage. The unit has operated with entire satisfaction. It has been found necessary to replace the lead plate after cutting approximately one thousand discs.

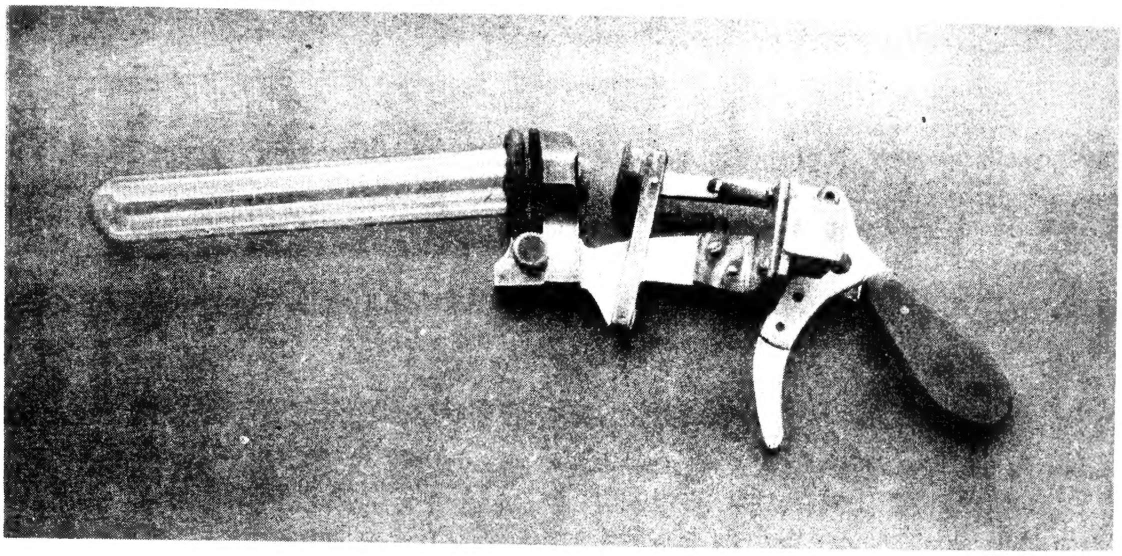

Figure 1.--General view of leaf punch.

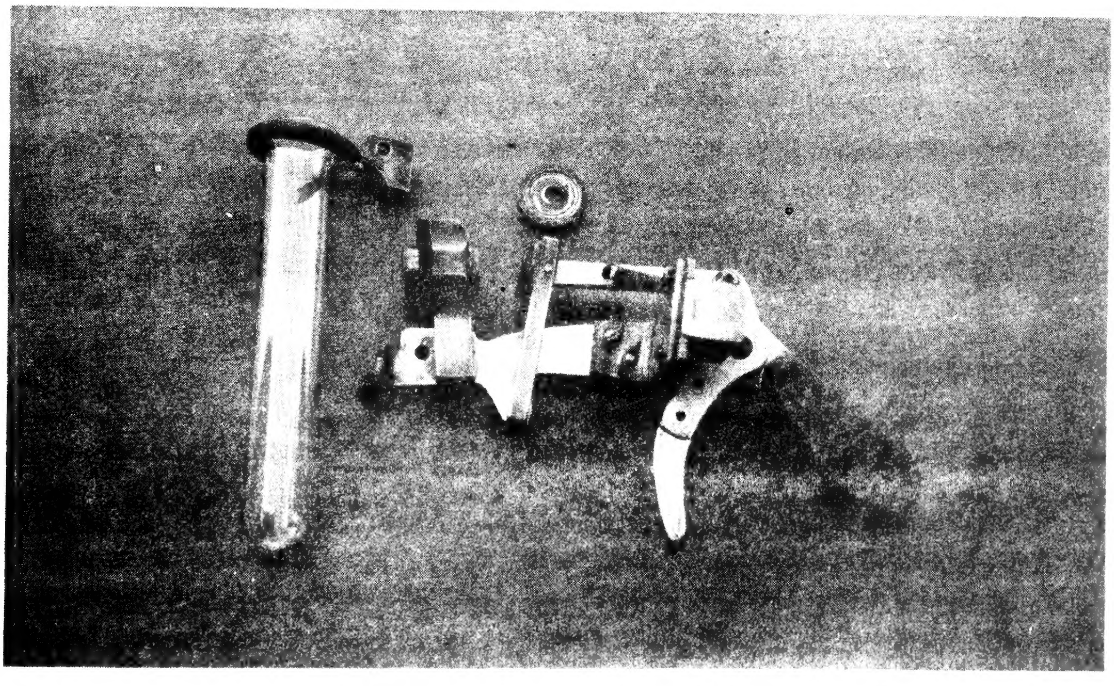

Figure 2.--Photograph of dismantled leaf punch, showing construction of test tube holder and lead disc cap.

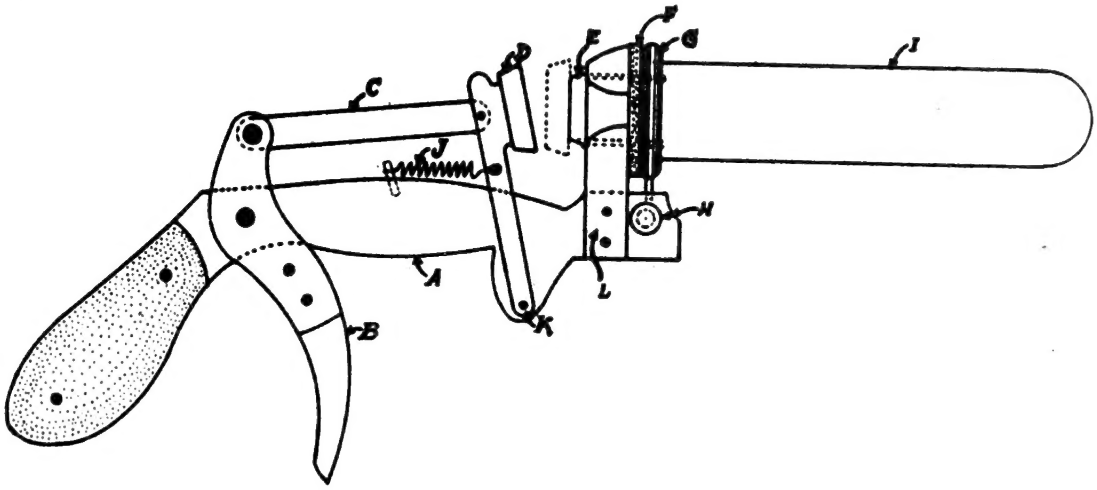

Figure 3.--A drawing of the leaf punch, showing arrangement of integral parts. A, Aluminum frame; B, trigger arm; C, thrust arm; D, compression unit; E, cutting tool; F, sponge rubber; G, test tube support; H, screw to fasten support to the punch; I, test tube; J, spring to release punch; K, bearing for compression unit; L, cutting tool holder. This drawing is approximately one-half natural size.